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INFORMATION REPORT INFORMATION REPORT

CENTRAL INTELLIGENCE AGENCY

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A thirty-page English translation of a report on the technical development of ferrous metallurgy in the CEMA states The report, which is dated June 1958, was prepared by the Secretariat of the Standing Committee for Ferrous Metallurgy of the CEMA countries. The report concerns the basic lines of technical development in various branches of the ferrous metallurgical industry in the CEMA countries for the period 1960-1975 and gives recommendations for improving the technical level and, in some cases, proposals for the construction of new plants.

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COUNCIL OF MUTUAL ECONOMIC AID

Permanent Commission for Economic and Scientific - Technical collaboration in the field of ferrous metallurgy.

FOR SERVICE USE

Basic lines of technical development of the ferrous metallurgy in C.M.E.A. member countries for the period 1960 - 1975.

WORKING MATERIAL

SEV/KChM - (SOVET EKONOMICHESKOJ VZAIMOPOMOSHCHI/
KOMISSIYA CHERNOJ METALLURGII).

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The present report concerning the basic lines of technical development of ferrous metallurgy in CMEA member countries for the period 1960-1975 is based on data submitted by the individual countries in accordance with the plans approved by the Permanent Commission for ferrous metallurgy of the CMEA, dated 16.12.1957.

The recommendations concerning the questions of development of techniques in various branches of ferrous metallurgy, worked out by the corresponding sections of the Permanent Commission, were also taken into account when compiling the (present) report.

Beside general recommendations, the sections of the report include, for information, steps for improving the technical level of ferrous metallurgy, proposed by the various countries, and in certain cases the countries' proposals for construction of new metallurgical works, shops and plants are explained.

The proposals for increased production and construction of new metallurgical works, shops and plants, are subject to scrutiny by the CMEA Permanent Commission for ferrous metallurgy when working out co-ordination proposals of future plans for development of ferrous metallurgy in CMEA member countries.

The general report on the basic lines of technical development of ferrous metallurgy is prepared by the Secretariat of the Permanent Commission, in collaboration with experts from the Bulgarian People's Republic, Hungarian People's Republic, German Democratic Republic, Polish People's Republic, the Soviet Union and the Republic of Czechoslovakia.

The working out and implementation of further technical development in branches of ferrous metallurgy and the introduction of new production techniques and technology should, finally, result in increased production of ferrous metallurgy produce in CMEA member countries: ferrous metal ores, agglomerates, coke, cast iron, steel, rolled metal, tubes and refractory materials; improve the quality of this produce and improve technical-economic indices of metallurgical works production. In the first instance this should increase the productivity of labour and ease working conditions, improve the use of natural resources, basic equipment and raw materials and lower cost prices and production expenses.

I. Output and treatment of ferrous metal ores

The output of iron ores in CMEA member countries has grown considerably during the post-war period, forging ahead of the tempi in capitalist countries. In 1957, compared with 1950, the output of iron ore has increased: 6-fold in Bulgaria, 3.7-fold in GDR, 2.75-fold in Poland, 1.6-fold in Rumania, 2.1-fold in USSR, and 1.7-fold in Czechoslovakia.

The increased output of iron ore was due to the improved technical level of the mining industry. As a result of increased mechanisation, adoption of more efficient mining methods and modern organisation of working methods, labour productivity has increased.

In CMEA member countries, the concentration (enrichment) of iron ore has been greatly increased, which fact has helped to develop the use of poorer ores. The proportion of ore undergoing partial or complex concentration compared with the total output is at present as follows: Poland 75%, Rumania 60%, USSR 51.5% and Czechoslovakia 83%.

Various methods of concentration are used: washing, jigging, magnetic separation, calcination, obtaining bloom from rotating furnaces.

New concentration equipment has been constructed: magnetic separators, jigging and floatation machinery etc.

As a result of increased output of agglomerates in CMEA member countries, the quantity of agglomerates has increased in blast furnace charges as follows: Hungary up to 40%, GDR up to 37.3%, Poland up to 55%, USSR up to 60% and Czechoslovakia up to 48%.

Production of fluxed agglomerates has increased, and this in turn has improved the quality of blast furnace charges and improved the output of the furnaces.

In spite of results achieved, further technical equipping of the mining industry of CMEA member countries is important, in connexion with the growth of ore output to satisfy the proposed development of ferrous metallurgy and to improve productivity of labour and economic operation of mining undertakings.

The basic requirements showing the lines of technical development in the mining industry of CMEA member countries for the period 1960-1975 are as follows:

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Considerable increase in mining output and use of poorer ores needing concentration; wide application of open-cast mining in spite of the considerable increase of the baring ratio; transition of (existing?) mines to deeper mining; development of mining undertakings, It is considered essential to increase the productivity of labour and to lower cost prices in the mining industry.

The following should be considered essential requirements in the technical development of mining:

Introduction of most modern methods of (geological) survey and most productive drilling equipment for survey work.

Use of most up to date methods of mining, local conditions in each country being taken into account.

Introduction of speedy methods of cutting and the use of modern and economic methods of bracing (timbering?).

Modernisation of existing machinery and equipment in order to increase their output and lessening their weight by using synthetic materials and plastics in particular.

Development of new machinery and equipment providing for increased productivity of labour and mechanisation of heavy manual processes.

Introduction of complex mechanisation, automation "despatching" as well as industrial television circuits.

The practical realisation of these basic lines requires increased research work in ore mining, safety measures, ventilation, elimination of dust and industrial noises.

<u>In Opencast Mining:</u>

Change over from the currently most widely used method of cable-percussion drilling to other methods and in particular to rotary and thermal boring. Development of rotary boring machines capable of cutting (heading) at all angles from 0 to 90°.

Selection of the better types of rotary boring machines and their testing in order to improve their design. Acceleration of designing and testing of thermal boring machines.

Study of new boring methods based on the use of electro-hydraulics, high frequency, micro-explosions etc. Selection of most suitable methods of boring and their introduction into the mining industry. Development of highly-brisant, cheap and safe explosives and also highly efficient plastic explosives for secondary crushing.

Mechanisation of charging bore holes by means of automatic chargers, especially when bulk (?) (ROSSYPNYE) explosives are used.

Use of electrical detonators with millesecond retarders for short-timing exploding of bore holes.

Wide use of rotary and multi-bucket excavators, drag-line excavators and rock(?) excavators (SKAL'NYE) with straight

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shovels and large bucket capacity. Use of rotary and multi-bucket excavators in conjunction with dumpers and dumping bridges. Use of powerful excavations for loading of friable species into haulers, in conjunction with mobile transloading hoppers. Increased production of excavators of various types and sizes for carying capacity workings. Use of excavators with lengthened equipment for digging approach and intersection trenches.

Increased load capacities of electric mining transport.

Use of diesel and electric engines with trailing weights of 100-150 tons. Use of auto-dumpers and trailers of 10, 25, 40 and 60 ton capacity when motor or tractor haulage is in use. Introduction of tip trucks with drop sides of 60, 90 and 120 ton capacity for transport of ore in the workings.

Mechanisation of labour-consuming ways of communication work: use of track laying and ballasting machines, track-moving machines and cranes of 40-50 ton capacity with jibs of 20-25m. Construction of concrete panel roads for motor transport.

Use of large tonnage motor and tractor transport at small and medium output workings if the haulage does not exceed 5 km. Use of excavator and plough dumpers, bulldozers (150-250 hp) with geared turning equipment at large mining undertakings, depending on prevalent technical conditions. Use of conveyor systems for getting rid of friable capping species.

Use, if conditions permit, of hydro-capping and water transport. Application of capping without transport at horizontal deposit sites.

Equipping "despatcher points" and the main equipment (excavators, electric engines) with short-wave radio sets and television installations.

<u>Underground workings</u>

Increased speed of shaft cutting up to 80-100 m. per month and that of horizontal workings up to 150-300 m. per month by applying modern methods of cutting and organisation of work.

Creation of new shaft boring machines capable of cutting a shaft of 6 m. diameter in hard rock formations at the rate of 100 m. per month; cutting combines capable of horizontal cutting at the rate of approximately 250 m. per month; boring machines for cutting rising seams in hard rock formations up to 1.5 to 2 m. in diameter.

Use of boring carriages for boring shot holes whilst cutting horizontal workings (seams?).

Use of small loading machines and also loading machines with scoop capacity of 0.8 - 1 cu.m. with caterpillar track (similar to small excavators) whilst cutting small section mines.

Shoring by means of sectional parts (concrete or other). Application of bolt shoring. Mechanisation of shoring work using shore-framing and shore-laying machines, guniting apparatus etc. Research into the mechanical method of shoring and setting of centering when the shoring is made of concrete.

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Mechanisation of ore removal in subdrift mines and under hatches(?) (LYUKI), clearing of tracks and drain ditches, track-laying and jointing of boring rods for deep boring.

Use of "storey" lifts for men and materials when the "storeys" are more than 60 m. high.

Increased weight-lifting capacity of haulage equipment - introduction in large mines of trolleys of 4 - 10 cu.m. capacity in conjunction with electric locomotives of 20-30 ton trailing weight.

Improved performance of electric locomotives and safer traffic conditions by introduction of "despatcher" control by means of electric block signalling system, high frequency communications between the "despatcher" and the drivers using the contact network, and installation of television.

Expediting of loading and unloading operations and transport staff cuts by introducing automatic loading from "hatches", remote control of electric locomotives and unloading of trolleys at points adjacent to the shafts.

Introduction of first the crushing process underground and introduction of conveyor systems for ore transport underground.

Improved construction (design?) of centrifugal mining pumps, increasing their efficiency and reliability.

Automation of draining work at existing and new mines. Improved aerodynamic qualities and design of main ventilation installations so as to increase their efficiency and reliability. Introduction of the simplest form of automatic ventilation and decrease ventilator noise. All mines to go over to artificial ventilation.

Introduction of washing or dry suction with the simultaneous use of micro-must (MIKROTUMAN) and hydraulic bursts(?) (GIDRAVLICHESKIE ZARYADY) during boring operations.

In the field of upraising: Introduction of complete automation in skip upraising. Introduction of multi-cable upraising in deep mines. Use of bottom unloading(?) skips.

In the field of pneumatic installations: Use of mobile compressors of 6-10 cu.m. per minute capacity at opencast sites. Improvement of design of existing compressor installations. Masterning of production of automatic control for piston compressors of 30-60 - 100 cu.m. per minute capacity, with capacity control equipment. Construction at important mines of central compressor stations equipped with turbo-compressors with up to 500 cu.m. per minute capacity.

Beside the main and general directions enumerated above, CMEA member countries envisage the following measures:-

BULGARIA: During construction of KREMIKOV mine, installation of most modern mining transport and concentration equipment with a view to higher labour output and cheaper cost price of concentrates. At KRUMOVO underground deposits - use of electric instead of Diesel haulage.

HUNGARY: Further expansion of limonite and also siderite and "ANKERIT" mining. Introduction of small boring machines for deep core boring in underground workings. Adoption of more productive methods of mining with storing and stoping. Use of lighter boring carriages, and also adoption of trolley instead of accumulator locomotives for haulage.

East Germany

~~G.D.R.~~: Adoption of more productive methods of mining - subdrift stoping with storing on sharp dips and chamber system on sloping dips and use of deep shot holes. Use of joints (fastenings?) in sinking work and millisecond blasting.

POLAND: Adoption of electric power in place of compressed air in mines of CZESTOCHOWA and LECZICKI areas. Improvement of mining methods (continuous, core) in iron ore seam deposits. Complete mechanisation of shot-hole boring, breaking down and backing in long walls. Modernisation of mine transport and introduction of the "despatcher" system. Use of conveyors for the mechanisation of extraction from long walls. Study of water regimes in mines and tapping of water from workings. Study of surface subsidence and systems of extraction of protective barriers. Study for final selection of most economical means of mining according to local conditions.

RUMANIA: Increase of opencast iron ore extraction from 38% in 1958 to 60% in 1965. Bringing production of ferrous metal ores by use of high productivity systems up to 75%. Use of excavators with scoop capacities of up to 4 cu.m. at opencast workings. Introduction in deep mines of systems of subdrift strike mining with the use of deep shot-holes and storing of ore. Wide use of pneumatic drills and use of "wet" boring (flushins?). Introduction of flushing machines and boring machines for mining of rising seams.

U.S.S.R.: Increase of opencast mining from 48(?)% in 1957 to 70% in 1965. Construction of large undertakings with an output of up to 15-30 million tons per annum on opencast workings and of up to 7 million tons per annum at deep mines. Use of rotary and thermal boring at opencast workings. Introduction of rotary and multi-scoop excavators, draglines with scoop capacity of up to 25 cu.m., and straight shovel excavators with scoop capacity of up to 15 cu.m. Introduction of Diesel locomotives, motor tip-cars and tip-cars of up to 90-120 ton capacity. Introduction of (new?) systems of shaft boring and use of multi-cable elevators. Change over to new boring methods in mines - ball cutting, percussion-rotary boring, use of portable (sunk?) drills when going through rock or in clearing work. Introduction of scraper winches with a power of up to 100 kw. Change over of underground transport to wagons of up to 25 ton load capacity and electric locomotives of up to 35 ton trailing weight. Wide introduction of obligatory stoping with the help of deep shafts.

CZECHOSLOVAKIA: Improvement of existing mining systems and introduction of new ones with a view to shortening the time of stope clearing and preliminary earth-work. Decrease in impoverishment of ores, increase in economic production and safety measures. Study of new methods of rock destruction - thermal, high frequency and others. Introduction of complex mechanisation of mines and quaries. Use of deep shafts (of up to 10 m. and over) in clearing work and mining systems without "backing of mined space". Mechanisation of backing work when the "backing" system is in use. Mastering of production of

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hammer drills of VK.12, VK.21 and VK-0-28 types (Note: VK may also stand for BK) for dry suction of dust and "wet" boring. Introduction at the main haulage strikes of trolleys of 2-5 cu.m. capacity.

In the Field of Preparation of Ores for Smelting

Development and introduction of more effective concentration methods and the intensification of concentration processes with the view to improving the quality of concentrates. Application of floatation, improvement of floatation methods, development of cheap and effective floatation anion and cation reagents. Utilisation of back water. Development of methods for neutralising reagent residues in drains.

Mastering of magnetic sintering technology to obtain high grade concentrates. Development of more modern and economical methods of megnetic sintering concentration of iron ores by increasing the degree of magnetisation during sintering, expediting the sintering process, decreasing thermal consumption for megnetic sintering and using cheaper fuels (natural gas, solid fuels). Development of design of higher output and economic sintering furnaces. (Furnaces for sintering in malten layer etc.).

Application of closed and semi-closed magnetic systems, pulsating magnetic fields and new materials for intensification of magnetic concentration.

Mastering of developed magnetic concentration schemes which include re-purification of the magnetic product and provide for production of high grade concentrates containing 62-64% of iron.

Mastering of gravitation methods of concentration with application of concentration in heavy suspensions, jigging of finely crushed ores (less than 0.2 mm.) in hydrocyclones, screw (spiral?) separators and the organisation of grannulated powder ferrosilicon production for the concentration process in heavy suspensions.

Application of multi-stage and combined technological processes of concentration for production of high grade concentrates and extraction of all valuable components from the ores.

Realisation of the change over from partial to complete automation of concentration plants.

Research into new designs, technological processes and high output equipment for crushing, concentration and dehydration of ores and also into intensification of existing processes and modernisation of plant by the use of higher speeds and vibration, centrifugal force, high tension and high frequency voltages, atomic energy, including the finishing stages of the work on ball-less grinding of ores, centrifugal jigging and desintegration in centrifugal field.

Change over to completely fluxed (fused?) agglomerates and reduction of the basicity of the agglomerate to such dimensions as to exclude, as far as possible, charging of limestone into blast furnaces.

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Carrying on with successive work on agglomeration with the use of bottom blast, heated and enriched with oxygen, and also on gas agglomeration and on baking (clinkering?) of the charge with varying quantities of fuel (along? depending on?) the height of the charge.

Neutralization of the ore, concentrates, fuel and fluxes (fusing agents?) before agglomeration to such a degree as to achieve neutralization of raw ore of up to 1%.

Mastering and introduction of Martens agglomerate production technique.

Currying out research and design work on automation of agglomeration plants.

Design and production of modern high-productivity equipment for agglomeration processes: an agglomeration machine with baking (clinkering?) surface of 200 sq.m. with coil and band coolers, tubular (tube?) vibro-conveyors for transport of hot return, vibrating screens for sorting of agglomerate etc.

Development and introduction of methods of balling finely ground concentrates with or withoutfurther heat treatment.

Development in producing completely fluxed (fused?) "OKATYSHI" (balls?).

Research into methods of removing sulphur from the ore during the "OKATYSHI" heat treatment.

Mastering the production of "OKATYSHI" suitable for open hearth treatment.

Development of design and production of equipment for "balline" of ore concentrates.

Individual CMEA member countries contemplate inter alia the introduction of the following measures:-

BULGARIA: Mastering of complex iron ore concentration technology at KREMIKOV deposits with separate extraction (recovery?) of iron, manganese, barite and lead.

HUNGARY: Development and introduction of an economical technique of siderite-barite ore concentration at RUDABANYA (phonetic) deposits. Development and mastering of methods of concentration of carbonate-manganese ores. Increased volume of output of agglomerates and "balling" of iron ores.

E. Germany
~~G.D.R.~~: Further development of bloom production technique at ~~the~~ VEB MAXHÜTTE, ~~works~~ Bergnau-, and Hüttenkombinat.

POLAND: Further development of the technique of preparation for smelting of siderite ores, mastering of the technique of producing bloom from ferruginous sand (gravel?) and research work into use of marcasite ~~(pyrite?)~~ cinders of ferro-zinc ores. Putting into effect of measures for concentration, sorting and neutralization of all ores. Construction of a central concentration plant at BURKI. Completion of

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Metallurgical Combine in Nowa Huta

construction of large crushing, sorting and neutralization plants at the ~~LENIN~~ and ~~BEIRUT~~ the BIERUT Metallurgical combines in Czestochowa.

TELIUC RUMANIA: Mastering of ore concentration techniques at TELYUK (ph.) deposits. Construction of a semi-industrial plant using the heavy suspension concentration method, magnetic sintering in boiling (molten) layer, magnetic separation etc. Development work on concentration techniques of ferro-manganese ores from ~~MONYA~~ (ph.) deposits and manganese ores from VATRA DORNEI (ph.) deposits. MONOR

U.S.S.R.: Construction and operation, at the main mining areas of the country, of experimental-industrial plans of 50-100 ton per 24 hrs. capacity for semi-industrial experiments of new techniques of magnetic sintering and floatation processes of concentration and also for concentration in heavy suspensions and nodulising of concentrates. Rebuilding of existing works and improvement of present methods of concentration with a view to producing higher iron content in concentrates and reducing losses of iron in residues. Research work with a view to discovering methods of removing arsenic from the iron ores of the KERCH deposits. Mastering of the "tower" method of washing manganese ore in the NIKOPOL'-MARGANETS basin.

Introduction at VYSOKOGORSKIJ mine of a method of concentration which provides for extraction of all valuable constituents. Development of methods of preparation for smelting of the complex ores of KACHKANARSKIJ, KOVDORSKIJ, KOPANSKIJ, ORSKO-KHALILOVSKIJ and other depodts which provide for extraction of all valuable minerals. Neutralization of iron ore in the KRIVOJ ROG basin and construction for this purpose of area (HAJON) ore neutralization warehouses (dumps?). Construction (at oil refineries and chemical works) of (special) shops for production of floatation reagents.

Mastering of the production of ferrosilicon for use in heavy suspension concentration processes.

CZECHOSLOVAKIA: Rudnany Mastering of concentration techniques for the complex ores of ~~RUDNYANY (ph.)~~ deposits, providing for extraction of 3 constituents: iron, barite and sulphide. Construction of mobile concentration plants of 10-100 ton per 24 hrs. capacity using gravity, magnetic and floatation methods of concentration. Further development of bloom production techniques through the preliminary concentration and neutralization of ores; increased life of furnace linings and automation. Production of bloom suitable for immediate use in open hearth production.

II. Coke-chemical production

In the post-war period, simultaneously with the development of ferrous metallurgy, the technical level of coke production has gone up considerably in CMEA member countries. Coke production during 1950-1957 increased as follows:- Hungary 2.7-fold; G.D.R. 2-fold; Poland 1.9-fold; Rumania 6.3-fold; USSR 1.75-fold, and Czechoslovakia 1.4-fold.

It should be noted that the People's Democracies experience great difficulties in supplying coke to the ferrous metallurgy industry, because of the shortage of coking coals

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especially of the 35-38 grade. A number of coking plants produce metallurgical coke of low lasting quality, which entails uneconomic quantities being used in blast furnaces, and hitherto not all chemicals have been extracted during the coking process.

The coke-chemical industry of CMEA member countries has carried out measures with a view to increasing supplies of raw materials for coking and decreasing the percentage of low-grade coals in the charge. Coal concentration plans have been built, as well as warehouses and dumps with neutralization and measuring facilities.

Coke production from brown coal on a commercial scale has been achieved in ~~the G.D.R.~~ East Germany

The crushing of coal mixtures has been improved. In Poland and Czechoslovakia the tamping method of coke production is widely used. In the USSR and Rumania experimental work on new methods of coke production from gas coals and low clinkering property coals, producing shaped (moulded?) coke of require size, has been carried out. In Poland, development on improved heating of coke ovens when using low clinkering property coals, has been introduced.

Bearing in mind the further development of the coke-chemical industry, and in order to improve its technical level and improve the quality of coke in CMEA member countries, the general lines of development should be considered as follows:

Maximum increase in metallurgical coke production from own coal resources.

Widening of raw material resources by increased use of low clinkering and gas coals in the mixture.

Development and introduction of new and more efficient methods of concentration, preparation and coking and of recovery and treatment of chemical by-products of coking.

Development of the coke-chemical industry as a whole, to a degree which greatly exceeds the needs of the metallurgical industry and wholly meets the requirements of coke, coke gas and chemicals of all branches of national economy.

Beside the general lines enumerated above, individual CMEA member countries have the following measures in view:-

BULGARIA: Construction of coking plants and putting into operation in 1962 of one coke oven battery with a gross output of 350,000 tons of coke per annum, the output of this plant to be doubled in 1964.

HUNGARY: Development of coke production and putting into operation in 1960 of the second and in 1972 the third coke oven battery.

East Germany
~~G.D.R.~~: Decrease of coal coke consumption in all branches of industry by the increased use of coke from brown coals, and also by the change-over from coke to gas in power plants.

Increased production of high temperature coke from brown coal and improvement of its quality. Adaptation of existing oven batteries for the tamping coking process. Replace-

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ment of old batteries at gas factories by modern ones of higher oven capacity and adapted for the tamping process.

POLAND - Coal Concentration

Development of the wet concentration method, so that by 1970 concentrated coal deliveries for coking should reach 100%. Increased degree of concentration so that the ash content of the concentrated mixture should be of 7% by 1975. Wide introduction of the selective crushing method of the coal mixture. Ortanisation of joint concentration of grade 33 coals from various mines of the Upper Silesia basin at central concentration plants. Increased participation (sic) in mixtures of gas coals (grade 33) of up to 40.2% in 1975 as compared with 32.8% in 1950, and consequent decrease of participation (sic) of gas-coking coals to 35.4% as compared with 46.5%.

Coking

Increased use of blast furnace and generator gas for the heating of coke ovens, thus releasing coke gas to the chemical industry and domestic uses. Improved uniformity of coke oven heating and improved servicing (maintenance?) by improved "hydraulic regime", introduction of cycle charts, replacement of heads [redacted](NASADKA) and repairs to coke ovens. Development of cracking methods of oil residues and other organic matters in under-roof areas of oven chambers, with a view to increasing the ethylene content of coke gas. Development of production of special purpose furnace coke and also electrode coke on the basis of pitch [redacted]) and clinkering coals. Development of continuous methods of production of pitch with softening temperature of 150°C and its coking "in weighed condition" (sic) (after weighing?). Development of production of pitch substitutes for bonding (coal tar and others). Continuation of research into new methods of coking developed in Poland. Automation of technological processes in coal preparation, coking, recovery and treatment of chemical products.

Recovery and treatment of chemical products and purification of drainage effluents

Mastering and application of benzol (C_6H_6) recovery technique and elimination of hydrogen sulphide (H_2S) from coke gas under pressure. Perfection and development of wet elimination of sulphur from coke gas up to complete discontinuation of the dry method. Elimination of poisonous effluents in drains and utilisation of carbolic acid ($C_6H_5.OH$) resources (residues?). Application mainly of the benzol method for elimination of carbolic acid from drain effluents. Concentration of treatment of coal tar and benzol products at large and specialised plants capable of producing a wider selection of chemical by-products. Introduction of continuous methods of crystallisation, polymerisation and distillation of treated coal tar fractions and benzol products. Study and mastering of new methods of coal tar treatment with application of catalytic oxidation of fractions as well as direct recovery of phthalic anhydride and anthraquinine. Study of new methods of treatment of benzol products by catalytic hydrogenation with a view to obtaining sulphur-less products in larger quantities in particular xylene and other organic solvents.

RUMANIA:

Production of coke (after 1965) from low-clinkering

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quality and non-clinkering coals by one of the new methods which are being developed by CMEA member countries. Further development of better quality metallurgical coke production methods, for blast furnaces of 700 cu.m. capacity. Application of differentiated crushing of the various components of the mixture mainly for the purpose of very fine crushing of "OTOSHCHAYUSHCKIE" components. Improvement of concentration of coal from VALYA ZHIULUJ (ph.) fields with a view to increased output and supply of various grades of coal. Further development of semi-coke production from grade 31 coals by "fluidisation" (FLUIDIZATSIYA).

U.S.S.R. - Preparation of mixture (charge?) and expansion of raw material resources for coking.

Use of coal from new colfields for coking purposes. Use of gas coals and low clinkering grades of coal for coking. Mastering and application of new methods of preparation of coal for coking: differentiated crushing of the various components of the mixture, selective crushing of coal from Eastern areas.

Extensive development of concentration of coals for coking, aiming at 100% of such coals for all deliveries and increased concentration of coals as regards ash and sulphur content. Study of new concentration methods: in heavy media, centrifugal, unclassified coals, in hydro-cyclones, in high frequency jigging machines, pneumatic concentration of small grade coals with possible petrographic concentration of small grade coals with possible petrographic concentration. Intensification of dehydration processes of concentration by means of special centrifugal apparatus and accelerator reagents. Modernisation of present methods of concentration in jigging machines. Study of preliminary treatment of coals with a view to increasing their clinkering properties. Heat treatment, treatment by heavy fractions of tar (pitch? resin?), high frequency treatment etc.

Coking and construction of coke ovens

Construction of large high-output coke-chemical plants. Modernisation of the present method of coking in chamber ovents. Development of design of continuous action ovens. Increased useful capacity of oven chambers by means of increasing all dimensions - length, height and width, in order to improve the technical-economic index of coke oven production and at the same time maintaining the quality of metallurgical coke. Introduction of coke ovens with bottom feed of heating gas and air, and separate regenerators (regenerative furnaces?).

Mastering the method of tamping the mixture of low baking quality coals (large proportion of gas coal and low baking coals) or other methods of mixture packing.

Continuation of development of new method of coking, producing coke of required size.

Development of complete mechanisation and automation so as to eliminate heavy manual handling.

Development of the dry quenching method and of rational utilisation of secondary sources of heat.

Development of control processes of coking with a view to obtaining the maximum of benzol and phenol products.

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Improvement of the coaling method of direct gas (sic) by intensifying the efficiency of the coaling systems and water cooling towers and improved preparation (treatment?) of return water.

Recovery and treatment of chemical products and purification of drain effluents

Introduction of the benzol method of extracting carbolic acid from drain effluents and improvement of the steam circulation and bio-chemical methods.

Introduction of flame pre-heating of saturated absorbing oil. Wider use of coke gas for synthetic ammonia and urea production. Much greater production of sulphuric acid from coke gas hydrogen sulphide. Investigation into new methods (ammonia or others) of recovery of hydrogen sulphide from coke gas.

Treatment of coal tar (pitch?) and benzol products at large central plants in order to increase the variety of chemical by-products of coking, lowering of costs and improvement of the technical-economic indices of the processing shops. Wider development of chemical production at coking plants: phthalic anhydride from naphthalene fraction etc.

Design and manufacture of more modern, productive and efficient equipment for the coke-chemical industry. Wide use of corrosion-resistant materials in order to lengthen the useful life of the equipment.

Simplification of inspection (KONTROL') procedure by the introduction of mechanical and automatic selection of samples and testing.

CZECHOSLOVAKIA

Development of the wet concentration method, so that by 1975 concentrated coal deliveries for coking should reach 100%. Increased degree of concentration, so that the ash content of concentrated coals should be of 7.5% in 1975.

Introduction of selective crushing methods.

Development of cracking methods for oil residues and other organic raw materials in under-roof areas of oven chambers with a view to increasing ethylene content in coke gas.

Application (in the main) of the benzol method of carbolic acid extraction from drain effluents.

Automation of technological processes in coke preparation coking chemical recovery and treatment shops.

Carrying out work in connection with the use of semi-coke from brown coals for agglomeration of iron ores.

? Iron Smelting Industry ?

III - BLASTING INDUSTRY

The rapid growth of cast iron production in CMEA member countries during the post war period was accompanied by a noticeable technical improvement in the blasting industry.

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During that period new modern blast furnaces have been built and put into operation. A great many shops have been reconstructed. As a result of capital expenditure on a large scale, output has gone up, the technological processes have improved and better economic indices achieved. Output in CMEA member countries has increased from 23.6 million tons in 1950 to 47.2 million tons in 1957, in other words - doubled. Measures taken for improving the technology and organisation of output from blast furnaces has resulted in an improved ratio of utilisation of effective capacity in 1957 as compared with 1950 as follows: Hungary from 1.55 to 1.37 cu.m./t.; ~~GDR~~ from 1.52 to 1.33 cu.m./t.; Poland from 1.72 to 1.21 cu.m./t.; Rumania from 1.57 to 1.36 cu.m./t.; USSR from 0.97 to 0.79 cu.m./t.; Czechoslovakia 1.34 to 1.10 cu.m./t. In Bulgaria the ratio was 1.29 in 1957.
East Germany

During the same period the consumption of dry coke per ton of open hearth pig iron decreased as follows: Poland from 1,188 to 1,000 kg., USSR from 960 to 815 kg., and Czechoslovakia from 1,168 to 1,037 kg. Consumption went up slightly in Hungary, ~~GDR~~, and Rumania: in Hungary and ~~GDR~~ because of lower metal additives to the mixture and in Rumania because of the use of locally-produced coke with high sulphur content. Time taken from capital overhead of blast furnaces has noticeably decreased and so have current stoppages.

It should nevertheless be pointed out that there exist certain shortcomings at a number of works: ore concentration is not practised at all works; at a number of works agglomerates are not used, the basicity of fusing agents is low and at some works fused agglomerates are not used at all. The blast temperatures are low, blowers and air heaters are not powerful enough. A number of serious violations of blast furnace smelting technology are in existence.

The further improvement of the technical level of blast furnace production for the period up to 1975 is planned on the following lines (apart from measures in connection with the dressing of mixtures detailed in the section dealing with production and preparation of ferrous metal ores);

Increased size and improved design of blast furnaces.

Construction of new large blast furnaces. Increasing size of existing blast furnaces during repairs and improving their shapes. Introduction of modern mechanised blast furnaces to replace old ones of small size. Increased use of carbonic refractory materials for the lining of hearths and hearth blocks, use of high alumina refractory materials in blast furnaces and air heaters. Development of more modern filling apparatus, standing up to gas pressures of 1.5 atm. at the furnace top. Introduction of cooling by evaporation of blast furnace and air heater-gates on a large scale.

Intensification of the blasting process and perfection of technology. Modification of a certain number of blast furnaces to operate with gas pressure of 1.5 atm. at furnace top with utilisation of thermic and physical energies of furnace top gas. Application of more economic types of checkers (packing?) and high refractory materials in air heaters in order to bring up the blow heat to 1,000°C. and over. Blowing into blast furnaces of natural (and coke) gas in combination with oxygen. Discontinuation of smelting of ferrous alloys in blast

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furnaces, these to be smelted in electric furnaces. Development of smelting of low manganic content pig iron. Separate feeding into blast furnaces of coke of different size and introduction of separate charging of different size ores. Application of preliminary desulphuration in order to obtain metal with the least possible sulphur content.

Mechanisation and Automation

Automation of collection, weighing and feeding processes to the skips by introduction of weighing trolleys (wagons?).

Testing on a commercial scale and mastering of complex automation of the technological process of pig iron production. Mechanisation of heavy manual processes at the hearth and mould yard (turning (swing?) conduits?) for pouring metal into ladles?)

Testing on industrial scale of various methods of direct recuperation of iron (PRYAMOE VOSSTANOVLENIE ZHELEZA) and creation of industrial high-capacity and economic plants for durect production of metal. Beside the main lines of development enumerated above and in addition to them, CMEA member countries contemplate the introduction of the following measures in particular:

HUNGARY: Reconstruction of blast furnaces and increase of useful capacity by introduction of carbonic refractory materials for the lining of hearths and hearth blocks ~~at DUNAJ VASHMYU (ph.~~) and OZD (ph.) works. Modification of operation of blast furnaces at the ~~DUNAJ VASHMYU (ph.)~~ and LENIN combines to use higher gas pressure at the furnace top. Increased blowing temperatures for blast furnaces of 700 cu.m. capacity to 900 - 1,000°C, and for smaller ones to 800 - 900 C. by re-checkering (PERENASADKA) of air heaters and increasing their heating surfaces.

East Germany

~~G.D.R.~~: Carrying out of tests on uses of ferro-coke (ZHELEZOKOKS) and its application in production. Research into blowing powdered lime and and fuel into the tuyeres. Application of controlled blowing on? tuyeres. Use of brown coal high temperature coke in the mixtures of low-shaft blast furnaces. Construction and mastering of operation of low-shaft circular blast furnaces with an output of up to 300 tons per 24 hours (when blowing is enriched with oxygen) of briquettes with lime additive. 25X1

POLAND: Construction of large blast furnaces, including some of 1,513 cu.m. capacity. Wide use of dressed mixture including fluxed (fused?) agglomerates with 0.8 - 1.1 basicity.

RUMANIA: Application of pig iron smelting in electric blast furnaces. Introduction of the use of liquid fuel and natural gas for partial replacement of metallurgical coke. Development of desulphuration of pig iron outside blast furnaces and conversion of HUNEDOARA (ph.) combine blast furnace to operation with fluxed agglomerates.

U.S.S.R.: Use of natural gas, and oxygen enriched heat blowing up to 1,100 - 1,200°C. in order to economise on coke and to increase output of blast furnaces. Introduction of complex automation of blast furnaces and agglomeration plants, including automatic checking of the technological process of smelting by computer(?) (SCHETNO-RESHAYUSHCHI). Construction of blast furnaces of 1,719 and 2,286 cu.m. capacity.

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CZECHOSLOVAKIA: Carrying out of industrial tests for comparative results obtained from thin and thick-wall construction blast furnaces. Development of the method of packing of hearth blocks with carbonic mass. Application of mathematical - statistical analyses for processing data on the operation of blast furnaces.

IV - STEEL MAKING

The technical level of steel making in CMEA member countries has gone up considerably since the war, a fact which has contributed to the rapid increase in steel output. The overall figure in CMEA member countries has gone up from 36 million tons in 1950 to 67 million tons in 1957, i.e. by 87%, thus beating the development tempo in the capitalist countries of Europe.

Simultaneously with the reconstruction of steel mills destroyed during the war, new modern open hearth furnaces and high production capacity shops, equipped for pouring steel into moulds from trolleys, and with special equipment for mould stripping, were built and put into operation; in other words, modern planning of the main shops and auxiliary divisions was being carried out. Such shops have been constructed in the U.S.S.R., Poland, Czechoslovakia and Hungary. At the same time the reconstruction of existing shops was carried out. With a view to increasing output, some open hearth furnaces were modified for double melt (DVOJNAYA SADKA). Furnace, pouring and mixture bays were reconstructed. Mechanisation and automation of steel making processes was carried out and new mixers were built, all of which contributed to increased quantities of molten metal in furnace charges and improved mixture making of melt. High frequency and electric arc furnaces of higher capacity, equipped with mechanical charging from the top and automatic control of electrode feed, have been introduced.

Wide use of oxygen blowing in steel making has been introduced. For example, in the U.S.S.R. steel making with the use of oxygen went up from 7.6 million tons in 1956 to 11.5 million tons in 1957. At the PETROVSKIJ and KRIVOJ ROG mills, steel making in converters with use of oxygen has been introduced. <~~At MAXHÜTTE in G.D.R.~~, the operation of BESSEMER converters with oxygen blowing has been mastered. One steel mill in Czechoslovakia has mastered the use of oxygen to intensify the smelting process. The use of oxygen has contributed to the improved technology of steel making, especially in the recasting of steel alloy waste in electric furnaces.

Measures taken in connection with the modification of open hearth furnaces for operation with (arched) roofs made of refractory magnesite-chromite brick have provided for the application of increased thermic loads and intensification of the smelting process, and have also contributed to the longer life of the furnaces.

Reconstruction and development of pouring bays in shops has also been carried out - the introduction of pouring from trolleys the increased weight of ingots, the construction of sites for the preparation of casting moulds and the stripping of ingots as well as the mastering of the continuous pouring method. Piling presses have been constructed at some bedding plants. All the above measures have resulted in an increased production of steel per square metre of hearth space of open hearth furnaces. Comparative figures for 1950 and 1957 are as follows: USSR from 5.36 to 7.32 tons; Czechoslovakia from 4.01 to 5.56 tons; Hungary from 4.90 to 5.40 tons; Poland from 3.90 to 5.10 tons; GDR from

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from 2.95 to 4.83 tons. In Bulgaria the production per sq.m. was 3.93 tons in 1957. It should be mentioned, however, that as well as the positive results achieved in steel making in CMEA member countries, the technical and economic level of steel making at some individual mills has not yet reached modern level, as compared with the results achieved at leading undertakings.

Long periods of idleness during hot and cold overhauls (especially during repairs of hearths) are still prevalent. Excessive mixture and refractory material consumption. Unsatisfactory output due to losses of metal in slag and during pouring by syphon. Losses of metal in trimming due to the slowness of application of heat treatment of ingots (deadhead). Measuring and testing equipment is not working (not in working order?) at many shops. The engineering industry has not yet produced powerful and economic oxygen plants, a fact which slows down the introduction of steel making with the aid of oxygen blowing.

The basic lines of technical development of steel making for the period up to 1975 should be considered as follows:

Development of the use of oxygen in all processes of steel making and also that of cold high-calorific value fuels not requiring preliminary heating in regenerators.

Rational use of available natural gas resources in steel making.

Construction of high capacity open hearth furnaces, electric furnaces and convertors and also reconstruction of existing plants with a view to increasing cubic and thermic capacity.

Development of pouring techniques and change over of some open hearth furnaces to double melt(?).

Application of continuous pouring method.

Although open hearth production will remain the basis of steel making, it should be borne in mind that steel produced by blowing open hearth pig iron with pure oxygen, can be of near quality to that produced by the open hearth method especially in carbonic grades; for this reason converter production with the use of oxygen should be developed with a view to the treatment of all available scrap.

In order to lengthen the working life of steel making plants, it is considered rational to develop new refractory materials to be used in various parts of open hearth and electric furnaces and converters. Production of high quality steel alloys in induction and electric arc furnaces with melting electrodes, by the deep vacuum method.

Radical improvement in preparation methods of metal scrap prior to smelting by providing the metal industry with powerful packer-presses and equipment for sorting and preparation of scrap.

Wide application of mechanisation and automation of all metallurgical processes and also the introduction of spectral analysis for chemical analyses of the metal and slag during smelting.

Recovery of secondary power resources by the application of steam evaporation cooling of plants as well as the use of recovery boilers.

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Besides the general lines of development enumerated above, individual countries are contemplating the introduction of a number of measures, in particular:-

HUNGARY: Organised supply to smelting plants previously desulphurated scrap and molten iron with lowered silicon content. Increased temperatures of air and checker heating for open hearth furnaces and regenerators of up to 1,300 - 1,500°C. at the same time increasing their performance (STOJKOST') by steam or air blowing or use of chemicals to dissolve dust. Complete change over to steel pouring from trolleys instead of stationary casting pits. Decrease of reject material down to 1.5% and increase in acceptable product by improved smelting technology and steel pouring, heating of ingots, use of better quality refractory materials, higher metal temperatures, development of boiling steel smelting (sic) (VYPLAVKA KIPYASHCHEJ STALI). Decrease in cold and hot overhaul of furnaces and improved repair technology. Use of natural gas for open hearth fuel. Use of agglomerates in open hearth production. Further introduction of automation of the thermic regime of furnaces. Construction of continuous steel pouring equipment, based on the experimental equipment in operation in Hungary since 1956.

~~G.D.R.~~: Construction of special cupola furnaces using brown coal dust, for melting of iron prior to pouring into open hearth furnaces. Introduction of trolley pouring at the smelting shop of the BRANDENBURG Mill. Further introduction of semi-continuous steel pouring at ~~FREITAL Mill~~ and construction of a continuous pouring plant of 190,000 tons per annum capacity at ~~RISA Mill~~. Construction of a steel mill equipped with 30-50 ton capacity converters using oxygen, and electric arc furnaces of 70 t. capacity. Change over of the THOMAS shop at ~~MAXHÜTTE~~ to operation with oxygen enriched blowing. Construction of steel mill for production of large forgings and tubes and equipped with installations for vacuum pouring of steel into ingots of up to (illegible) tons weight. Wide development of production of heat resistent steels for boiler making and heat resistant ferrite steels for the power industry. Development of production of low-alloy steel.

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POLAND: Introduction of preliminary desulphuration of the molten metal in the ladle of a rotary furnace by using crushed lime or by blowing neutral gas mixed with lime power. If positive results are obtained, introduction at processing plants of cupola furnaces for melting metal for open hearth shops. Improved construction of open hearth furnaces by improving the caps, increased capacity of regeneration chambers and use of high quality refractory materials in the lower past of the furnaces and regenerator capping. Intensification of steel making technology by increasing the thermic capacity of furnaces, use of oxygen, use of better quality refractory materials and introduction of automation. Electric smelting - increased capacity of transformers. Introduction of induction method of bath stirring in furnaces of over 25 t. capacity. Construction of three converter shops for use with oxygen blowing. Steel pouring - increased ingot weight, wide application of trolley pouring from the top, degressing of high grade steel by vacuum, heat treatment of paying part of large ingots, introduction of continuous pouring and improvement in quality of refractory materials. Considerable increase in production of low-alloy steel, stainless, ball-bearing low-watt-loss transformer and "automatic"(sic) steel. Increased production of stainless (chrome-nickel) steel substitute based on chromium and manganese.

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RUMANIA: Development of converter process with use of oxygen in converter and "ROTOR" type furnaces. Development of "duplex" process: converter or "ROTOR" furnace - open hearth furnaces, or converter or "ROTOR" furnace - high capacity electric furnaces. Production of high grade steel in rocking open hearth furnaces or large electric furnaces with electro-magnetic stirring of the metal. Application of vacuum pouring.

U.S.S.R. - Construction of large capacity open hearth and electric furnaces and converters. Further development of steel making in open hearth furnaces and converters with oxygen blowing. Organisation of "duplex" process of steel making - converter-electric furnace. Trials in connection with steel making in new type furnaces. Application of vacuum process for pouring and smelting. Application of continuous pouring. Research into complete automation of steel making processes by open hearth method.

CZECHOSLOVAKIA: Construction of two steel mills (shops) with 30 - 60 t. converters operated with oxygen, after which steel making by this method will reach 3.5 million tons in 1975. Improvement of operation of existing plants by intensification of technological processes, use of oxygen, fuels of higher calorific value, lengthening of life span of furnaces, use of high grade refractory materials and mechanisation and automation of heavy manual processes. Increase in paying product output by application of continuous pouring. Improved quality of special alloy steels, application of vacuum method of pouring, and mastering of productions of new grade steels.

V. ROLLING AND TUBE ROLLING

1. Rolling

The technical development of the rolling industry in CMEA member countries increased greatly during the post war period with the result that the output has increased two-fold as compared with pre-war days.

During this period a great number of new and modern rolling mills have been built hand in hand with the reconstruction and modernisation of mills destroyed during the war.

At the same time many of the existing mills have been reconstructed. Heating equipment has been improved, some mills have changed over to liquid fuel and gas, the loading and unloading have been mechanised, automatic thermal control has been installed at a number of mills.

At a number of mills the main power plants have been replaced by more powerful ones, heavy manual processes have been mechanised both at the mills and auxiliary shops.

The technological processes have improved. The specific weight of hot ingots going into the pits has increased, the weight and measurements of ingots ready for rolling has increased, cogging in proportion to output has gone up and so has rolling time.

Guide-rounds have been installed at both ends at wire and small section rolling mills.

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Steps have been taken for better organisation of capital and running overhauls, for increasing the size of rolled products by (already) partially achieved specialisation of the mills.

Individual countries have carried out considerable work in connection with the mastering of production of heavy type rails, including high carbon steel ones.

Production of special sections for concrete reinforcement made of heightened flow limit steel and also a mber of sections for the engineering industry and lightened girders and channel bars for the building industry.

At a great number of mills the rolling is carried out with a lowered degree of + tolerance.

At the same time it should be noted that at a great number of works in CMEA member countries the technical level has not yet reached modern standards, as regards both equipment and the technical-economic results of the operation of rolling mills.

A great proportion of rolling is done on old and obsolescent plant. The plants producing hot or cold rolled sheet are insufficient and hold up the economic production of bent thin-walled sections and welded tubes. Production of sheet steel amounted to about 26.4% of the overall rolled production for 1957.

Production of tin plate is sadly lagging behind both in output and technical standards. Very little tin plate with modern coatings is being produced (black lacquer, enamel, plastic coating).

Not enough electro-technical steel is produced for industry, production of cold rolled texture transformer steel with high magnetic properties is insufficient.

Lightened economic sections rolled at existing plants are still produced in small quantities (lightened girders, channel bars and angled sections).

The assortment of rolled sections is limited, modern rolled sections such as "wide shoulder" girders etc. are lacking.

Dressing and cleaning as well as the finishing processes are not fully mechanised.

At a number of works the heating and thermal installations are a source of bottlenecks which limit the rolling output and heat treatment processes.

Basic lines of development in CMEA member countries during the period 1960-1975 should be as follows:-

Great increase in production of hot and cold rolled sheet and hot and cold rolled strip. At the same time, wherever economically expedient, production of sheet by "roll" (RULONNYS) method at modern continuous rolling plants.

Construction, in countries where this is economically expedient, of completely mechanised and automatic modern high speed rolling plants with continuous and semi-continuous disposition of stands for production of graded and fashioned sections

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(small section plants with speeds of up to 15 m., medium section plants with speeds up to 12 m. and wire plants with speeds up to 30 m. per second and over).

Construction in countries with lesser non-ferrous metal output of mechanised sheet and graded section plants of lesser capacity (checker, cross country, etc.) for rolling of standard and high grade steels.

Modernisation, wherever technically and economically expedient, of existing equipment of rolling, section and sheet mills by increasing motive power of plants, change over to gass or liquid fuel, mechanisation of plants and finishing operations, installation of mechanised cooling plant etc.

Change over at wire mills of linear type, where manual handling is in operation and "loop" groups of finishing lines, to continuous groups, bearing in mind the quantities of available metal at the works.

Liquidation of obsolescent low-output rolling plant requiring heavy manual handling and not suitable for modernisation, as soon as new plant becomes available.

Organisation of increased economic production of shaped sections by bending process and also by welding at special shops, as a result of increased rolled sheet output,

Increase (in countries where such a measure would be economically sound) of steel sheet production by modern technological methods of cold rolling on high speed plants (30 m. per second and over) equipped for degreasing, electrolytic tin plating, annealing, dressing and sorting during the process. Sufficient production of tin plate (0.20 - 0.22m/m.). In countries with low output of steel sheet - introduction of mechanised single stand cold rolling plants for production of rolls, with automatic tip pla ting and finishing.

Development of production of steel sheet with modern economic coatings - lacquer, enamel and plastic.

Introduction of galvanised sheet production in rolls in modern plants.

Increase in production of cold rolled electro-technical steels (transformer and dynamo) of high magnetic properties, to ensure reduction in size and increased efficiency of transformers, electrical machinery, apparatus and equipment.

Organisation of production of new type electro-technical steels in rolls, which would facilitate higher labout efficiency mechanisation and automation of processing and economy of metal at undertakings using such steels.

Organisation in individual countries of production of economic sections of "wide shoulder" rolled girders and also production of welded shaped sections at specially designed shops. Development of lightened girder and channel bar sections. Development of introduction of new type of hot rolled "periodic" reinforcement for concrete constructions, with high mechanical properties, which would ensure economy of metal in building.

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Development of production and introduction in rolling mills of magnesium treated roughly chilled low alloy cast iron rollers.

Introduction at all metallurgical undertakings of the building up of steel rollers with hard alloys and surface hardening of gauge.

In order to free labour resources and ease work at dressing points of blanks and ready rolled production, development and introduction for commercial operation of the following:

(a) Machines for flame dressing (complete or local) in hot stream and cold condition at bloom and slab stores.

(b) Machines for mechanical processing (planing, milling) of ingots, blooms and blanks in hot condition, as well as for grinding (trimming?) by abrasive discs (wheels?) in cold condition.

(c) Machines for cold mechanical dressing of ingots, blooms and slabs and ready-rolled products by planing, milling and polishing.

(d) Plants for mechanical scaling of metal surfaces by hydraulic, shot and other processes.

(e) Machines for straightening of section metal as well as combined machines for straightening, grinding and polishing of rods.

(f) Machines for stamping and marking of blooms, slabs, blanks, rolled sheet and sections during production.

(g) Machines for sorting and packing of rolled sheet and sections.

(h) Machines for turning (manipulation?) of large sections and rails at checking stands.

(i) Machines for packing and tying of thin sheet and strip.

Reconstruction of existing obsolescent heating furnaces and introduction of new modern ones, completely mechanised and automatic (sectional quick heating, ring furnaces and others).

Development of heat treatment for rolled produce in automatic and mechanised furnaces - tunnel, with roller and pacing (SHAGAYUSHCHIE) hearths, domed, with electric heating in protection medium (ZASHCHITNAYA SREDA).

For improved rolling accuracy - production and introduction, at plants where conditions warrant it, of pre-stressed stands, development of use of bearings for rolling and liquid friction as well as roller guides.

Application at all new section and sheet rolling mills of complex automation of production, their equipment with modern non-contact measuring apparatus for checking measurements of rolled product at intermediary and final stages.

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Automation of individual operations at existing plants - trimming of ends, straightening of ready product, pressure installations at stands and other sections.

Completion of complex automation of reversible blooming mills as per programme.

Introduction of automatic control systems at cold rolling sheet and strip mills.

Development and application of computers(?)for automatic regulation of cutting of blanks at continuous blank mills(?) (with a view to the suppression of cutting losses by cutting on even quantity of strip without waste).

Development of installations for automatic weighing of semi-finished and finished rolled products as well as automatic counters for determining quantities of individual rolled products (blanks, rails, girders, rods, sheets, tubes).

With a view to further greatly improving labour productivity by the introduction of the latest technical and scientific methods in the rolling industry in CMEA member countries, according to the needs of the national economy and the importance of the rolloig industry in individual countries, it is recommended that the following modern types of mills, plants, technological processes and rolled products should be developed:

Wire mills operated on continuous rolling principle, with speeds of up to 60 m. per second.

Planetary (planet) mills for rolling of wide plate and sheet.

Multi-roller mills for cold rolling of wide thin strip (0.05 m/m).

Mills for production of tubular (hollow?) wagon axles and lightened (light duty?) wheel pairs.

Presses for production of shaped sections from alloys difficult to deform by extension process. Plants for production of shaped sections by drawing and cold rolling methods.

Special stands for the production of staged (periodic?) rolled product by the lateral rolling method.

Three-high mills for lateral rolling of round sections. Continuous methods of of heat treatment of section and sheet metal, incorporating automatic and mechanised furnaces, as well as heat treatment from (immediately following?) rolling, which provides for great economy of metal, allows for replacement of carbon dead melt by bubbling steel or of high grade alloys by alloys of lower grade, at the same time increasing the useful life of metals, as instanced by heat treatment of rails etc.

Pre-heating before rolling and heat treatment in neutral medium, as well as application, in countries well supplied with cheap electric power, of electric heating of metals (by resistance and induction methods).

Apparatus for automatic exposure and elimination of metal defects (magnetoscopy, supersonic waves etc.).

Machines for grinding and polishing of sheet during the production process.

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Tube Production

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In view of the greatly increased demand for tubes in CMEA member countries, a number of measures aiming at increased production and improved technical standards, as well as increased variety, have been implemented in CMEA member countries. Great attention was paid to the development of production of seamless rolled tubes as well as the economically sound process of producing electrically welded tubes.

During the period 1945-1957, a number of new tube rolling mills producing seamless tubes have started operating in CMEA member countries. For instance: a new mill in Rumania, producing seamless tubes of up to 400 m/m in diameter; three new mills in Hungary; two new mills in ~~the G.D.R.~~; two new mills in Poland, and five in the U.S.S.R. At the same time modern plants for electric and furnace (PECHNAYA) welding (fusion welding?) of tubes have been installed.

Simultaneously reconstruction and modernisation of existing mills has been carried out. At a number of mills existing heating furnaces have been reconstructed and new one built, power plants replaced by more powerful ones, individual sections have been mechanised. The process of heating of ingots and skelp has been quickened at a number of mills. Automatic control of the heating process in furnaces has been introduced. The rolling process has been intensified by improved calibration of piercing, automatic, "pilgrim" (pilger?) and other mills. Overhaul of mills has been improved.

At some undertakings automation schemes for individual rolling processes and sections of tube rolling have been developed and implemented, including the establishment at hot (rolling) sections of a series of automatic regulators of rolling speed. At some mills the length of tubes has been increased.

A great number of new grades of steel and new tube shapes is being produced in CMEA member countries.

As a result of the measures described above, tube production in CMEA member countries has more than doubled in the 1950-1957 period. At the same time it should be pointed out that some tube rolling mills in CMEA member countries are lagging behind both in quantity of production and technical level (quality).

The equipment of pilger mills needs radical modernisation in order to increase output and also produce tubes with thinner walls and of highter precision.

In a number of cases drawing tube mills are equipped with obsolescent plant. Production of electrically welded tubes (especially large diameter ones for gas and oil pipe-lines) is not entirely sufficient for the needs of the countries. Tube mills are insufficiently equipped with modern machinery for finishing processes (drum presses for water tests, machines for cutting and notching tubes and unions, mechanised presses and plant for cold straightening of tubes, special machines for boringm grinding and polishing of outside and inside surfaces etc.

Production of variable section tubes and especially thin-wall tubes for deep boring, as well as bi-metal tubes, is insufficiently developed. The newest automatic checking-measuring apparatus, as well as heat treatment and heating of metal in shielded atmosphere (ZASHCHITNAYA ATMOSFERA), is not sufficiently used.

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The basic lines of technical development in the tube rolling industry for the period up to 1975 in CMEA member countries should be considered as follows:-

Construction and operation of tube mills equipped with plant for resistance welding of tubes of from 6 to 530 m/m in diameter, with installations for induction welding of tubes of ½" to 4", for arc welding under a layer of flux and induction welding of high pressure gas-oil pipeline tubes of up to 1,020 m/m in diameter, with continuous furnace(?) (PECHNAYA) (fusion?) welding for production of gas pipes of 1/8" to 2", with reduction stands capable of rolling tubes at the rate of 400 m. and over per minute, with continuous stands for production of seamless tubes of 30 to 102 m/m in diameter and walls of 1.75 m/m in thickness and over. Reconstruction of existing "pilgrim" (pilger?) mills and construction in individual countries of new "pilgrim" (Pilger?) mills for production of tubes of from 12" to 24" diameter, and including piercing presses, elongating stands, "FORGOLLER" stands with hydraulic braking, and calibrating stands. Organisation and development of production of precision tubes at existing works by construction of new shops: electrically polished tubes, "BEZRIS--OCHNYE" tubes with very thin walls, capillary tubes made of high alloy steels, as well as the economic production of variable section tubes, shaped pipes, etc.

Organisation of production of bi-metal tubes and tubes with various metal and non-metal surface coatings as well as tubes made of piercing resistant steels by press (extrusion?) method.

Reconstruction of existing shop producing cast iron tubes by changing over to centrifugal or semi-continuous casting. Research into and application of conveyor centrifugal casting method.

Design and introduction to the tube industry of most modern finishing equipment - drum presses for water tests, complex stands for trimming and threading of tubes and unions (joints) mechanised presses and stands for straightening, automatic lines for transporting and finishing, special machines for boring, grinding and polishing of inner and outer surfaces etc.

For further heightening of the technical level of tube production and development in accordance with modern scientific and technical achievements, it is proposed to introduce the development of the following new tube rolling mills, equipment and processes in CMEA member countries, according to the available resources and economic requirements in each individual country:

Planetary and continuous cold rolling tube mills.

Latest automatic and mechanised drawing mills for new design i.e. drum, continuous, triple-thread and others.

Pre-stressed stands with liquid friction bearings at cold rolling mills.

Reeler mills and presses for both very thin and very thick walled tubes as well as high productivity finishing equipment.

Heating furnaces, including continuous heating ones with non-oxidant-heating (gas, electric and induction) in particular for heat treatment of precision and extra thin-walled tubes.

Checking and measuring apparatus for checking during production process - defectoscopes, thickness measuring apparatus

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diamometers, meterage and quantity counters and rolling precision regulators.

High temperature mechanised electric saline baths for pre-heating of metal prior to hot pressing.

Continuous action furnaces for quick heating of skelp and tubes, including (furnaces) with flameless burning of gas in ceramic burners and also electric furnaces.

Calibration of cold tubes by plug gauge.

Continuous casting of steel and bi-metal skelp (at experimental works).

It is considered desirable to provide for complete automation of all processes where building new tube rolling mills and works.

It is recommended that automation and mechanisation of individual processes at existing mills should be developed and implemented, special attention being paid to the mechanisation of dressing and trimming processes of semi-finished and finished products.

It is considered rational to provide for the wide cooperation between CMEA member countries, whilst the above recommendations are being implemented, in the production of individual kinds of tubes and rolled products (inter-exchange of sections of certain dimensions, or various grades of steel, re-rolling of semi-finished product etc.) In the case of certain kinds of rolled produce and tubes, theneed for which in each individual country does not warrant the construction of modern mills, it is considered rational to envisage the production of such items in accordance with the overall requirements of CMEA member countries.

It is also suggested that individual member countries should carry out the following:-

HUNGARY: construction and operation of a semi-continuous wide bar hot rolling mill and a sheet cold rolling mill. Erection of multi-roller (multi-high?) cold rolling mills for the production of strip up to 250-300 m/m wide. Construction of a modern small section mill. Development of production of electrically welded tubes by increasing production of wide bar and sheet. Elimination of bottle necks in heating of metal by construction of new furnace pits and holding furnaces with automatic thermostatic control, as well as the reconstruction of existing heating installations. Modernisation and mechanisation of finishing processes in rolling and tube shops.

East Germany

~~G.D.R.~~: Construction of a blooming-slab mill with hot and cold rolling wide bar stands. Construction of a modern mechanised small section mill for rolling high grade steel. Development of production of transformer steel by increased production of thin bar. Construction of a "STIEFEL" [illegible] mill for production of seamless tubes and all automatic tube welding plant. Development of extrusion process in tube and section making when dealing with metals difficult to deform. Reconstruction and mechanisation of heating equipment.

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POLAND: Complete mastering and operation to capacity of the continuous hot rolling sheet mill at the ~~LENIN NOWA HUTA works~~ Metallurgical Combines in Nowa Huta and putting into operation of the cold rolling sheet mill. Construction of a modern plate mill, blooming mill and continuous skelp mill, modern section mills and a wire (rod) mill. Elimination of bottle-necks in metal heating by the construction of new and the reconstruction of existing heating installations as well as their automation. Construction of new shops for the production of seamless and electrically welded tubes, a welded tube shop and general modernisation of existing tube shops. Development of special rolling - bent sections, wagon axles, shaped sections spherical, as well as development of the extrusion process. Wide reconstruction and modernisation of heat treatment installations. Improvement and mechanisation of finishing installations for tubes and rolled products.

RUMANIA: Completion of construction and putting into operation of the blooming mill and large section mill "650". Construction of a mechanised thin sheet and continuous small section mill. Erection of multi-roller cold rolling mills for cold rolling of strip and necessary equipment for finishing and heat treatment of quality strip. Organisation of bent section production. Organisation of production of small diameter tubes and thin-wall tubes.

U.S.S.R.: Construction and operation of modern blooming-slab mills, continuous skelp mills, sheet rolling, wire, section and tube rolling mills. Wide development of electrically welded tube production. Modernisation of existing equipment. Mechanisation and improvement of finishing processes of rolled products and tubes. Development of the extrusion process in cases of steels and alloys difficult to deform.

CZECHOSLOVAKIA: Construction of a continuous wide bar hot rolling mill and a cold rolling mill for sheet (in rolls), of modern productive section mills, a continuous wire and strip mill. Construction of "STIEFEL" (piercing?) tube rolling mill. Reconstruction of pilger mills at ~~KHOMUTOVO (pr.) works~~ the Gustav Klement Pipe Rolling Mills in Chomutov. Modernisation and reconstruction of existing rolling mills. Development of bent section production and extrusion processes.

VI. REFRACTORY MATERIALS INDUSTRY

The growth of metal production, the use of oxygen in metallurgical processes, high temperatures and vacuum used during smelting and pouring of metals and the intensification of various processes in the cement, glass and other industries have given rise to problems for the refractory materials industry requiring the production of better materials and the creation of new ones. The basic lines of technical progress in the refractory materials industry during the period 1960-1975 should be considered as follows:-

Development of geological survey with the aim of finding new deposits and increasing stocks of refractory raw materials. Extraction of raw materials for the production of highly refractory products (magnesite, chromite ores, high alumina content raw materials, zirconium ores, graphite and others). Utilisation of stocks of dolomite for the production of metallurgical dolomite and dolomite products. Development of mechanisation and automation of capping and mining work. Development of concentration of chromite ores, magnesites, sillimanites, cyanites, china clays and other refractory materials.

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Creation of mechanised dumps for raw materials and finished products. Construction of rotary furnaces for high temperature sintering, high output drying, crushing and mixing installations, all with a high degree of automation.

Development and increase in the use of semi-dry pressing. Creation and introduction of high output presses for semi-dry pressing. Creation of new designs for automatic presses with pressure increase from a few to 5,000 - 6,000 tons for products of varying weight, shape and density. Development in design of charging installations (for loading) into tunnel oven trolleys. Change over at existing works from ring and periodic furnaces to tunnel furnaces. Construction of new system furnaces for sintering at temperature of 1,700 - 1,950°C. Further development and improvement in semi-dry pressing methods and increase of assortment of fire clay products. Improvement in quality of fire clay products by raising the quality of clays and china clays, high temperature sintering in rotary furnaces heated by gas or liquid fuel, high pressure exercised during pressing and sintering in automatic tunnel furnaces. Organisation of production of high density fire clay blocks for blast and glass furnaces as well as hollot lattice blocks for air heaters.

Increased production of high alumina content products by the semi-dry pressing method with high temperature sintering and increased production of electrically smelted products for special requirements. Utilisation of powerful presses for production of blocks for powerful blast furnaces, for glass furnaces etc. Development of production of high density Dinas (silica refractory brick) for coke ovens, glass furnaces etc. Production of compact heat resistant semiacid products.

Development of production of high density periclase-spinellide refractory materials for the crowns of open hearth furnaces. Organisation of production of magnesite-dolomite refractory materials, unsintered reinforced magnesite-chromite refractory materials, unsintered magnesite-chromite blocks for electric blast furnaces. Development of production of forsterite (magnesium silicate) refractory materials. Organisation of production of magnesite-chromite and forsterite refractory materials, high resistance basic refractory materials for lining of converters working with oxygen blow and basic refractory materials for vacuum steel smelting and pouring. Organisation of production of synthetic metallurgical mixtures for building up and overhaul of hearths and slopes (?) (OTKOSY) of open hearth furnaces. Utilisation of high output equipment for fine grinding, of powerful hydraulic presses and tunnel furnaces for high temperature sintering of basic refractory materials.

Development of production of lightweight refractory materials - fire clay, dinas, high alumina, zirconium, etc. Development of the production technology of china clay and mullite cord, wool, fabrics and mats for insulation of high temperature furnaces.

Development of production of high alumina cements based on calcium aluminates and aluminium phosphates, production of refractory concretes, putties, coatings, mortars, and other refractory materials.

Development of production of special refractory materials from pure oxydes, carbides, nitrides, sulphides, "KERMETS" (kermesites?) and other materials.

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Beside the main lines of technical progress in the refractory materials industry, individual CMEA member countries contemplate putting the following into effect:-

BULGARIA: Development of geological survey with a view to obtaining raw materials for the refractory materials industry, including chromite ores, followed by the introduction of concentration methods. Development of refractory materials production up to the complete satisfactory of requirements in high quality refractory materials of the various branches of industry. Research into concentration of refractory clays. Development of technology for obtaining magnesium oxide from brine at salt works.

Utilisation of available stocks (resources?) of dolomites for production of high quality refractory materials.

Organisation of supplies for steel pouring and casting ladles by the semi-dry pressing method.

Increase in production of fire clay products up to the capacity of the tunnel furnace as well as the organisation of production of dinas, basic and forsterite refractory materials up to the requirements of the non ferrous metals industry and other branches of the national economy. Completion, within the next few years, of the change over from hand to machine moulding.

HUNGARY: Development of geological survey with a view to creating own raw material stocks. Application of the selective method of clay and quartzite extraction. Development of utilisation of natural refractory sands for lining of ladles.

Development of production of fire clay products by the semi-dry pressing method, including supplies for steel pouring. Production of high density fire clay products.

Organisation of special refractory materials production (glass cross bars, graphite crucibles), production of high density dinas material. Reconstruction of existing works with a view to replacement of obsolete equipment. Mechanisation and automation of production processes. Organisation of mass production of thermally stable magnesite-chromite refractory materials, periclase-spinellide, unsintered, reinforced etc., to satisfy completely the requirements of the metal industry.

G.D.R.: Research into economic and effective ways of extracting magnesium oxide from the chemical industry residues containing magnesia salts.

Development of production of magnesite and magnesite-chromite refractory materials from the chemical industry residues. Concentration of chromite ores.

Organisation of production of forsterite refractory materials. Organisation of production of basic refractory materials taking into account the change over of all open hearth and electric blast furnaces to basic refractory materials, also of high-alumina products and lightweight fire-clay and dinas products.

Reconstruction of existing works and their expansion, including the replacement of obsolescent equipment, dryers and furnaces.

Application of the semi-dry pressing method at the new fire-clay works and their equipment with modern plant and machinery, high productivity tunnel furnaces, including mechan-

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isation and automation of production processes.

Application of coke and generator gasses for the heating of furnaces.

Development of production of high grade sintering (clinkering?) dolomite. Application of rotary furnaces for sintering of dolomite at a temperature of 1,750°C.

POLAND: Carrying out geological survey work with a view to increasing supplies of quartzites. Increasing stocks of magnesite, chromite ores and high-alumina raw materials. Research work on concentration of magnesite raw materials, quartzites and fire clays.

Application of the semi-dry pressing method, introduction of modern fine grinding plant, mixers, powerful presses, tunnel dryers and furnaces at works being built or reconstructed.

Development of production and assortment of aluminosilicate refractory materials, high density, ultra lightweight, semiacid, high alumina, unsintered fire-clay refractory materials, high density, high-siliceous dinas, chromodinas and lightweight dinas.

RUMANIA: Development of geological survey work with a view to locating refractory raw materials. Utilisation of high alumina raw materials, i.e. bauxite, disthene (cyanite) etc., for production of high alumina products. Research into methods of recovering magnesite from serpentinites and other kinds of magnesia raw materials. Organisation of selective methods of raw material recovery

Development of production of high grade fire clay in rotary furnaces. Organisation of production of basic refractory materials. Expansion of existing works by better use being made of existing equipment and installation of modern, high productivity equipment, fine grinding mills, powerful presses and tunnel furnaces.

Utilisation of natural gas in the refractory materials industry.

CZECHOSLOVAKIA: Reconstruction of existing shops and works and construction of new ones with a view to increasing production of aluminosilicate refractory materials up to the requirements of the country. Equipping of works with plant for the simultaneous grinding of fire clay and clay, continuous mixers, powerful presses and tunnel furnaces. Application of automation and mechanisation in production processes. Development of the semi-dry process of pressing for production of fire-clay products and production of a wide assortment of high density, lightweight, semiacid and high-alumina products by introducing specialisation at shops and works. Organisation of production of high density and high siliceous dinas. ?

Development of production of basic refractory materials aiming at increased production of unsintered ~~(unfired?) box~~? ~~(KASSET)~~ brick, magnesite and magnesite-chromite brick of less than 14% porosity and products for the lower part of open hearth furnaces.

Organisation of production of electrically smelted magnesite and produce and powders from dolomitised magnesite.

Introduction of magnetic concentration of magnesites and concentration in heavy media. Construction of automatic shaft furnaces for magnesite sintering.

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U.S.S.R.: Increased geological survey with the object of locating high resistance refractory raw materials, in particular magnesite, chromite ores and high alumina raw materials. Utilisation of raw materials at existing magnesite, high alumina clay, olivenite, cyanite and sillimanite deposits.

Utilisation of magnesite-dolomite and dolomite supplies for production of filling (ZAPRAVOCHNYJ) powders and products. Continuing research into the economic and effective recovery of magnesium oxide from SIVASH Lakes brine. Introduction into production of concentrated magnesite, chromite ores, cyanites and sillimanites.

Replacement of obsolescent equipment at existing works by modern equipment for crushing, powdering and mixing and furnaces for obtaining highly sintered fire clay, magnesite and dolomite. Also replacement of periodic, chamber and ring furnaces by tunnel ones.

Designing and construction of automatic high-output presses for production of lining for steel pouring by semi-dry pressing, high density products and refractory blocks. Designing new high output tunnel furnaces for high temperature sintering, for sintering of large blocks, shaped dinas for the coke and glass industries, lightweight and special refractory materials.

Wide utilisation of natural and coke gas and liquid fuels.

Utilisation of high grade raw materials achieving decreased porosity of fire clay products and introduction of block lining of blast furnaces, air heaters, pouring ladles and other equipment. Development of production of high alumina products for special purposes and of high density dinas for coke and glass furnaces and other requirements. Expansion in production of high grade magnesia refractory materials for open hearth and electric furnaces and converters operated with oxygen blowing as well as for vacuum-operated furnaces. Development of production of various lightweight refractory materials.

Organisation of production of refractory concrete, putties, protective coatings, mortars, various refractory materials as well as special refractory materials made from pure oxides, carbides, nitrides, "KERMETS", sulphides and other materials, to satisfy new branches of technology.

Installation of more efficient dust collectors at industrial premises and collection and utilisation of dust.

Completion of mechanisation and automation at dumps of raw materials and stores of finished produce. Use of containers for transport of ready produce.

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